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The Value of QTc Dispersion in Assessment of Cardiac Risk in Elective Aortic Aneurysm Surgery

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Objectives: *To determine the value of QTc dispersion in predicting cardiac risk in aortic aneurysm surgery.*
Design: *Retrospective case-control study*
Materials: *One hundred and twenty-six patients who had abdominal aortic aneurysm surgery between May 1992 and April 1996.*
Methods: *Nine patients experienced a postoperative cardiac complication defined as myocardial infarction or cardiac death. Twenty-four age and sex-matched controls who had uncomplicated aortic surgery were selected at random. QTc dispersion was calculated from the preoperative 12 lead electrocardiograms.*
Results: *The mean QTc dispersion in the cardiac complication group was greater than the control group (63.1 $ms^{1/2}$ vs. 50.4 $ms^{1/2}$) but the difference did not approach statistical significance.*
Conclusions: *QTc dispersion cannot be recommended as a predictor of cardiac complication following elective aneurysm repair.*

Key Words: Abdominal aortic aneurysm; Cardiac risk assessment; QTc dispersion.

Introduction

The perioperative mortality rate after abdominal aortic aneurysm (AAA) surgery ranges from 3 to 6% and the major cause is cardiac disease.[1] The incidence of perioperative myocardial infarction in patients undergoing aortic surgery is approximately 6%.[2] A variety of techniques can be used to assess cardiac risk prior to aortic surgery, ranging from simple clinical parameters to more invasive investigations such as radioisotope measurement of cardiac ejection fraction. The techniques available currently can identify those patients considered to be high risk but there is no reliable method of predicting cardiac complications.[3]

QTc dispersion is a simple variable obtained from a standard 12 lead electrocardiogram by subtracting the shortest from the longest QT interval. The cellular basis for QTc dispersion has not been fully established but it may reflect patchy myocardial fibrosis or ventricular dilatation. Recently published data suggest that QTc dispersion can identify patients with peripheral vascular disease who are at risk of cardiac death.[4] We undertook this retrospective case-control study to determine if QTc dispersion could predict patients undergoing elective AAA repair who subsequently had postoperative cardiac complications.

Patients and Methods

One-hundred and twenty-six elective AAA repairs were performed at Gloucestershire Royal Hospital between May 1992 and April 1996. From a computerised database, nine patients, all men, were identified as having had a postoperative cardiac complication. Cardiac complications were defined as myocardial infarction (proven by ECG changes in conjunction with a rise in cardiac specific CK-MB enzymes) or cardiac death (determined at post-mortem). Twenty-four age- and sex-matched controls were selected at random from the remaining patients who had uncomplicated aortic surgery.

Data recorded from the patients' notes included age at operation, co-existent medical problems and radionucleotide-determined cardiac ejection fraction. No patient was taking antidysrrhythmic drugs which could affect the QT interval.

QT intervals were analysed from the preoperative 12 lead electrocardiograms by recording manually the

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Table 1. Clinical details of patients who had elective aortic aneurysm repair.

	Patients who had cardiac complications	Patients who had uncomplicated repair
Number of patients	9	24
Mean age in years (S.D.; range)	73.4 (4.8; 66–78)	69 (6.9; 51–85)
Previous myocardial infarct/ angina	2	2
Hypertension	2	9
Diabetes	0	2
Smokers	5	17
Cardiac ejection fraction – % (S.D. range)	60 (8.6; 52–75)	64 (6.8; 46–72)

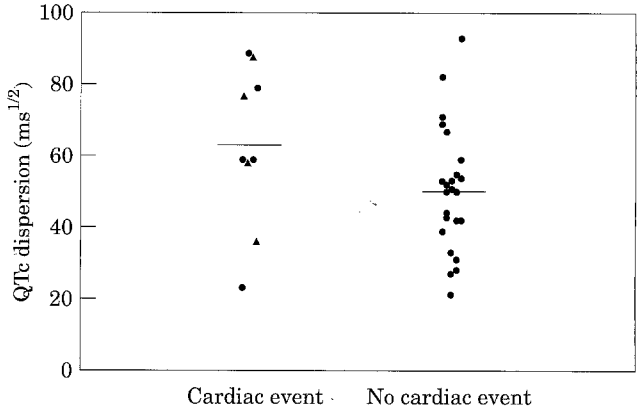

Fig. 1. QTc dispersion in patients having elective aortic aneurysm repair. (▲) Death from MI; (●) survivors.

interval from the onset of the QRS to the end of the T wave in all leads. Three consecutive cycles were measured for each lead. QT intervals were corrected with Bazett's formula ($QTc = QT/RR^{1/2}$) and then QTc dispersion was calculated by subtracting the minimum from the maximum QTc.[4] Variance analysis was used to test for statistically significant differences between the two groups.

Results

There were six deaths from 126 elective aneurysm repairs during the 4 years studied and post-mortem examination confirmed cardiac death in four. One patient died as a result of postoperative pneumonia and sepsis. The final patient developed a postoperative coagulopathy and died from subsequent multi-organ failure. In addition, five patients survived perioperative myocardial infarction. Preoperative demographics were similar in the two groups studies (Table 1).

The mean QTc dispersion in the group who experienced cardiac complications was greater than the control group (63.1 $ms^{1/2}$ vs. with 50.4 $ms^{1/2}$) but the difference did not approach statistical significance (Fig. 1). In addition there was no significant difference in mean QTc dispersion for patients who died (56.4 $ms^{1/2}$) compared with patients who survived perioperative myocardial infarction (71.4 $ms^{1/2}$).

Discussion

Abdominal aortic aneurysm surgery carries a substantial mortality and morbidity mainly due to cardiac complications. Accurate preoperative identification of the risk is essential in order to balance the risk-benefit equation of any operation and ensure informed consent from patients. A variety of methods of assessment are used, including exercise ECG, thallium stress test, isotope ejection fraction, echocardiography and coronary angiography.[3] Although the available techniques are capable of identifying patients considered to be at high risk, none can accurately predict the likelihood of a perioperative cardiac event. In Gloucester, all aneurysm patients have preoperative radionuclide measurement of cardiac ejection fraction; patients only have aneurysm repair if ejection fraction is >30%.

Glancy *et al.* have shown that prolonged QTc dispersion following acute myocardial infarction can identify patients at risk of subsequent cardiac death.[5] In addition, prolonged QTc dispersion in hypertensive patients indicates patients at risk of sudden death.[6] Darbar *et al.* concluded that QTc dispersion, particularly if greater than 60 $ms^{1/2}$, had a high sensitivity and specificity for identifying patients with peripheral vascular disease who would then suffer a cardiac death.[4]

The results from this retrospective study demonstrated a greater mean QTc dispersion in patients who had postoperative cardiac events, but the difference was small and not statistically or clinically significant. In addition, there were methodological problems with measurement of QTc dispersion. The technique is not standardised and is usually performed manually. Although potential inaccuracies introduced by intra- or inter-observer variation in measurement may be small, the technique would be more readily clinically applicable if any potential errors could be removed by adjusting current electrocardiographic equipment to provide automatic information on QTc dispersion.[7] QTc dispersion cannot currently be recommended as a predictor of cardiac complication following elective aneurysm repair.

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